SOIL SURVEY OF BEADLE COUNTY, SOUTH DAKOTA.

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DESCRIPTION OF THE AREA.

Beadle County is situated in the east-central part of the State of South Dakota. It is rectangular in shape, with a width of 30 miles and a length of 42 miles. It is bounded on the north by Spink and Clark Counties, on the east mainly by Kingsbury County, on the south by Sanborn and Jerauld Counties, and on the west by Hand County. The county has an area of 1,250 square miles, or 800,000 acres.

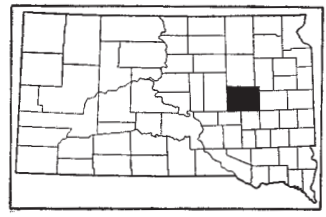

FIG. 43.—Sketch map showing location of the Beadle County area, South Dakota.

The greater part of Beadle County lies within the prairie plains of the James River Valley. A smaller strip of the Missouri River Plateau, known as the Wessington Hills, crosses the extreme southwestern corner of the county. The average elevation is between 1,300 and 1,400 feet. Iroquois has an elevation of about 1,400 feet, Huron 1,300 feet, and southwest of Virgil the altitude reaches 1,400 feet This elevation is probably exceeded in the Wessington Hills. The lowest elevation is along the James River where it leaves the county, and the highest elevations are in the extreme eastern and western parts of the county and in general paralleling the James River.

The Wessington Hills are the most distinctive physiographic feature of Beadle County and form the western limit of the old Missouri River Valley. The hills rise abruptly from the James River Valley to the Missouri Plateau in a distance of one-half to 1 mile. The hills are erosional, and have resulted from the work of many small streams that have extended their headwaters into the edge of the plateau. The ridges between these streams are narrow but sharp, becoming wider and flatter as one passes farther from the escarpment of the plateau.

The topography of the greater part of the county is typically that of a ground moraine, the surface being flat to undulating. That part of the county lying east of a line extending from Hitchcock to Huron, thence northeast to Yale, and thence south to the southeastern corner of the county is flat, except for occasional knolls, a small area east of Lake Byron, and narrow strips along Shue and Pearl Creeks; that lying west and south of this line is undulating.

The more undulating areas are found in Hartland and Broadland Townships and west of the Chicago, Milwaukee & St. Paul Railway. The soils in these more undulating areas are chiefly the Barnes and Pierce loams. Depressions occur throughout the county, but they are more numerous in the more undulating areas. These depressions all have water in them during the early spring, and a large percentage of them throughout the year, especially in seasons of comparatively heavy rainfall. In normal seasons many drain early enough to be cultivated, and hay is cut from some that drain later.

The drainage of the county is rather poorly established, the streams having few branches and the dissection being insufficient to carry off the rainfall. The greater part of the water runs into the depressions, from which it is gradually removed by percolation and evaporation. The county lies in the drainage basin of James River, which flows almost due south through the central part of the county. The average fall of this stream is less than 1 foot per mile. It is perennial, but its tributaries cease their flow during the summer months.

Besides the present streams there are many old glacial stream channels in the county. These divide and redivide, often reentering the main channel or joining it with other streams. Water accumulates in many of these during wet seasons. The valleys along these channels vary from very narrow to over 2 miles in width.

There are several lakes in Beadle County. The largest and most important is Lake Byron, which is the center of a summer resort. All the lakes are shallow and at times go dry; many are filled with rushes and other water-loving flora.

Beadle County was organized in 1881. The first settlers arrived in the seventies, but the first important settlements took place in 1880 and 1881. Most of the early settlers came from Wisconsin, Illinois, and Nebraska. Later Scandinavians began to arrive in increasing numbers and the present population is largely of Scandinavian descent, Norwegians predominating. The population of Beadle County in 1890 was 9,586, in 1910 it was 15,776, and in 1920 it had increased to 19,201. Huron, the county seat, was founded in 1881. It now is the largest town in the county, having a population of 8,302 in 1920. The smaller towns of the county include Wessington, Wolsey, Hitchcock, Broadland, Virgil, Cavour, and Bonilla. The rural population in 1920 was 7.2 per square mile. Huron and other towns have excellent schools. The water supply is a rather simple problem, as artesian water of good quality is found throughout the county at depths of 750 to 1,050 feet.

There are about 125 miles of railroad in the county. The Chicago & North Western passes through the middle of the county from east to west, entering at Iroquois and running through Huron and Wessington. A branch of this system extends from Huron northward to Hitchcock. The Great Northern Railway runs northeast from Huron through Sheffield and Yale. The Chicago, Milwaukee & St. Paul Railway crosses the western part of the county, passing through Bonilla, Wolsey, and Virgil. Notwithstanding these various lines, there are large areas situated 10 to 15 miles from shipping points.

The wagon roads follow land lines, roads being located on practically all section lines. During average seasons practically all of the roads can be traveled, and the county roads are kept in especially good condition. During such wet years as 1920 travel becomes almost impossible even on the highways, owing to the large numbers of poorly drained spots. Three highways or trails cross the county. The Black and Yellow Trail passes through the county from Iroquois to Wessington. The Sunshine Trail passes north and south through Bonilla, Wolsey, and Virgil. The Avenue Road traverses the county on the sixty-first range line. The Black and Yellow Trail is being graveled east of Wolsey. Practically all the small streams are bridged. There are, however, only 10 bridges across James River.

The rural schools are very good, several consolidated schools being found in the county.

CLIMATE.

The climate of Beadle County is subhumid, with rather long, cold winters and short summers. Thawing weather usually begins in March and field work starts about the first part of April. The springs are quite cool; the summer months usually have long, warm days and cool nights. Hot south winds sometimes occur in the summer, and may cause some damage to crops.

The average date of the last killing frost in spring is May 10, and that of the first in the fall September 22. This gives an average growing season of 134 days, which is sufficient for the maturing of early varieties of corn. The latest recorded date of killing frost in spring is June 8 and the earliest in fall August 23. Freezing weather begins the latter part of October or first of November and continues through the winter, except for occasional short periods. The falls are usually dry, with clear, cool, snappy weather. The average snowfall is 24.7 inches per year.

The reports of the Weather Bureau station at Huron are taken as typical for the county. The reports show the mean annual rainfall as 21.10 inches. Most of the rainfall comes from April to September, the average for this period being 16.62 inches, which is sufficient for the crops grown. Occasionally heavy rainfalls, such as those recorded for the wettest years, cause much damage to crops from inundation of the bottom land and poorly drained areas. The driest years recorded are 1910, 1894, 1899, and 1903, with 10.19, 13.56, 13.66, and 13.83 inches, respectively. The wettest years recorded are 1882, 1905, 1908, 1914, and 1920, with 28.12, 28.93, 28.67, 30.14, and 27.95 inches, respectively. It will be noticed that the precipitations for the wet and the dry years have been quite uniform.

The mean annual temperature is 42.1° F., with an absolute minimum and maximum of −43° F. and 108° F., respectively. The air is usually dry, causing the winter cold to be less penetrating and not so noticeable as higher temperatures in more humid climates. Winds occur throughout the year and blizzards sometimes occur during the winter, blocking roads and railroads. Such storms are usually of short duration and not so severe as popularly believed.

The following table of climatic statistics is compiled from the reports of the Weather Bureau station at Huron:

Normal monthly, seasonal, and annual temperature and precipitation at Huron.

[Elevation, 1,306 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1914).	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	15.7	65	−34	0.62	1.49	0.30	5.1
January	9.5	64	−43	.51	.23	.79	4.6
February	12.9	68	−37	.44	.10	.37	4.3
Winter	12.7	68	−43	1.57	1.82	1.46	14.0
March	26.7	85	−25	.99	.89	2.96	5.7
April	44.6	94	7	2.65	1.05	5.83	1.0
May	57.3	96	20	2.92	2.54	11.56	.3
Spring	42.9	96	−25	6.56	4.48	20.35	7.0
June	66.6	100	31	3.78	.48	.96	.....
July	71.5	108	41	2.94	1.43	1.29	.....
August	69.1	108	33	2.64	1.00	3.43	.....
Summer	69.0	108	31	9.36	2.91	5.68	.....
September	59.6	106	18	1.69	.52	2.35	.....
October	44.7	94	3	1.34	.17	T.	.6
November	27.4	77	−28	.58	.29	.30	3.1
Fall	43.9	106	−28	3.61	.98	2.65	3.7
Year	42.1	108	−43	21.10	10.19	30.14	24.7

AGRICULTURE.

The settlement of Beadle County began in 1880, although Charles Miner, reputed to be the first settler, located on section 14, T. 109, R. 61, near the mouth of Pearl Creek, in April, 1879, and a few other settlers filed on claims later in the same summer. During the next two or three years nearly all of the desirable land was filed on.

The first settlers in the county, from about 1880 to 1890, or a little later, produced wheat almost exclusively. Only an occasional farmer gave his attention to cattle or sheep. The rainfall during the early part of the decade was far above the normal, and the yield of crops was phenomenal. Wheat often yielded 40 bushels per acre. The succeeding drier years brought smaller yields of wheat and an almost total failure of the crop in 1894 and 1895.

Many farmers had bought expensive machinery and had mortgaged their farms, a large proportion of which were sold under foreclosure, the farms becoming the property of nonresidents. Hundreds of farms were abandoned and the population decreased.

The small percentage of farmers who had given their attention to stock raising were doing well. More corn began to be grown, and mixed farming with smaller acreage than formerly took the place of big wheat farms.[1]

The beginning of diversified farming in the last decade of the nineteenth century marks the transition from the pioneer period to the period of permanent farming. The following statistical tables from the Federal census reports of 1900, 1910, and 1920 show the development of the agriculture of the county:

[1] Historical Atlas of South Dakota. E. Frank Peterson, 1904.

Acreage of various crops, Beadle County, 1899, 1909, 1919.

Crop.	1899	1909	1919
	Acres.	*Acres.*	*Acres.*
Corn	22,083	51,345	105,242
Oats	7,331	28,267	40,950
Wheat	99,650	76,200	143,286
Barley	3,784	32,747	18,057
Rye	4,885	.....	4,184
Emmer and spelt	.....	19,185	7,538
Flax	1,911	25,387	6,822
Hay and forage total	.....	120,010	120,871
Timothy alone	.....	1,146	753
Timothy and clover mixed	.....	279	59
Clover alone	.....	36	283
Alfalfa	.....	454	9,138
Wild, salt, or prairie grasses	74,499	113,106	101,754
Kafir, sorghum, etc., for forage	.....	.....	261
Potatoes	954	1,204	988
	Number.	*Number.*	*Number.*
Apple trees	25	967	2,854
Plum trees	998	8,711	4,566
Cherry trees	.....	550	1,548

Number of livestock on farms and ranges, Beadle County, 1900, 1910, 1920.

	1900	1910	1920
Horses	9,225	16,858	18,860
Mules	131	365	530
Dairy cows, 2 years or older	10,013	9,193	6,114
All other cattle	29,505	28,807	51,270
Sheep	18,194	6,272	10,620
Swine	7,565	28,479	55,301
All poultry	64,568	143,160	207,213

Number and size of farms, value of farm property, and owner operators, 1900, 1910, 1920.

	1900	1910	1920
Population	8,081	15,776	19,273
Number of farms	1,094	1,609	1,716
Land in farms, acres	645,667	677,719	705,066
Average size of farms, acres	590.2	421.2	410.9
Value of all farm property	$5,241,964	$35,569,871	$82,277,250
Value of farm buildings	$591,920	$2,678,615	$7,031,555
Value of farm implements	$217,470	$897,103	$3,448,341
Farms operated by owners, per cent	73.0	62.3	57.6

From the data recorded in the foregoing tables it may be seen that the agriculture of Beadle County consists in growing the staple grain crops and forage and in the production of livestock. It is typical of the general farming regions of the Northwest. The major crops are wheat, corn, oats, barley, and hay, while emmer, rye, flax, and alfalfa comprise a minor group. Wheat has always claimed the largest acreage and is the principal money crop. About 57 per cent of the corn crop, 63 per cent of the oats, barley, and emmer, and 92 per cent of the hay is fed on the farms to the increasing number of livestock.

An examination of the census returns reveals the fact that there has been a great increase in the last 20 years in the area of land tilled. The leading crops grown have increased in acreage in every

case, but the steady increase in the wheat acreage is no doubt related to the increased demand for wheat during the period of the World War. The total hay and forage acreage changed but little during the period 1910 to 1920, although some of the wild hay area seems to have been displaced by tame forage crops. The great percentage increase in the alfalfa acreage during the same time is significant, as it marks the establishing of permanent legumes, which are valuable not only for forage but also for soil improvement.

The livestock population, with the exception of dairy cows and sheep, has greatly increased in the last 20 years, although the number of sheep has increased more than half since 1910. The increase of cattle other than dairy cows, of swine, and poultry is the most conspicuous. Notwithstanding the introduction of tractors the horse is more than holding his own.

The farmers of Beadle County recognize the value of crop rotation. The most common rotation is corn followed by small grain—a 2-year rotation—such as corn and oats, corn and wheat, corn and spelt. A 3-year rotation is also practiced consisting of corn, wheat, and oats, or corn, oats, and barley. A 4-year rotation consisting of corn and three years of small grain is sometimes employed. On new land flax is usually the first crop, followed by wheat, corn, and oats in the order named. The rotations rarely contain a legume as a regular step, but there is an increasing tendency to employ corn, small grain, and sweet clover as a basic rotation. In a large number of reports from reliable farmers corn was included in every rotation.

The land is always plowed before corn, and the stubble or stalks are usually disked in preparation for the following small-grain crop. Where small grain follows small grain the land is usually plowed, fall plowing being generally preferred.

Wheat was the most important crop in 1919, an area of 143,286 acres being harvested, yielding 1,114,293 bushels. Spring wheat is generally grown, and the most popular varieties are Marquis and some strain of amber durum such as Kubanka or Acme. The average yield of spring wheats is said to be 12.4 bushels. Winter wheat is grown occasionally, Kanred and Turkey being the popular varieties. The estimated average yield is 14 bushels. Wheat, like the other small grains, is frequently sown on corn land of the previous year. The land is disked and harrowed. Some of the wheat is broadcast and disked in, and some of it is seeded with a single-disk or double-disk drill. When wheat is seeded on plowed land, fall plowing is generally preferred. It may be broadcast or drilled. Nearly all of the wheat is harvested with an ordinary binder, although push binders and headers are sometimes used. Shock threshing is nearly universal and some of the wheat is marketed from the machine. Some farmers do not market at once, but most of the crop goes to market within a few months, because wheat is the first money crop available.

Corn is the second crop in point of number of acres and will undoubtedly increase in importance. The demand for wheat during the World War evidently retarded its normal increase in area. The commonest variety is Minnesota 13, a yellow dent corn. Other common varieties are Early Murdock, Early Yellow Dent, White Dent, and Wimples Yellow Dent. Corn is usually planted with a check-rower, but occasionally it is drilled. Listing is rare. Single-row and double-

row cultivators are used. About 7 per cent of the corn is cut for fodder, 4 per cent for silage, and 89 per cent is harvested from the stalks. Corn harvesters and pickers are used. A small acreage of corn is being "hogged off," and this practice will probably increase. About 57 per cent of the corn crop is fed on the farms, the rest being marketed at the elevators. Owing to the rather dry weather in the late summer and early fall the corn is usually in good market condition. The estimated average yield of corn is about 33 bushels per acre, but good corn farmers produce larger yields. Farmers are about equally divided in their opinions whether fall plowing or spring plowing is better for corn. Corn was grown on 165,242 acres in 1919, and yielded 2,423,548 bushels.

Oats occupied 40,950 acres in 1919 and yielded 1,114,293 bushels. Sixty-Day oats is the popular early variety and Swedish Select is regarded as the best late oats. Big 4 and Silvermine, as well as other varieties, are grown. About 63 per cent of the oats, barley, and spelt is said to be fed on the farms where it is produced. The estimated average yield of oats is about 36 bushels per acre.

The acreage of emmer and spelt was greatly reduced between 1910 and 1919. It was grown on only 7,538 acres in 1919, the estimated average yield being 28 bushels. The acreage of barley also decreased greatly in the same time, but it was grown on 18,057 acres in 1919, and produced 288,129 bushels, the estimated average yield being 24 bushels.

The flax acreage has decreased with the decrease of "new land." It was grown on 6,822 acres in 1919 and produced 63,088 bushels of flaxseed. The estimated average yield is 9.8 bushels per acre.

Alfalfa and sweet clover are the principal cultivated legumes. Alfalfa is sown for permanent mowings or pasture and the fields are usually small. The acreage is increasing. It usually is cut two or three times during the season and yields a total of about 2.5 tons per acre. Fields favorably located produce larger yields. Alfalfa seed is sometimes produced and average yields are estimated at about 3.5 bushels per acre. The preferred variety is Grimm. Cossack, South Dakota No. 12, Turkestan, Common, and Western South Dakota, are also grown. Sweet clover is becoming more common, as it is adapted to crop rotations. The average yield is estimated at 2.8 tons of hay per acre, and the yield of seed at 4.6 bushels per acre. Sweet clover is a money crop as well as a forage crop and a soil renovator. Alfalfa and sweet clover are also used as pasture crops for hogs and other farm animals. They are far superior to wild pasture and are necessary for successful livestock production. These crops may be seeded with oats or barley as nurse crops.

Potatoes are not extensivly grown, although fair yields are obtained in favorable years. This crop was grown on 988 acres in 1919 and yielded 50,679 bushels. The estimated average yield is 87 bushels per acre. The common variety is Early Ohio, with Rural New Yorker and Irish Cobbler as secondary varieties.

In 1919 there were 101,754 acres of land producing wild hay, yielding 99,622 tons. This land is usually mowed each year and the estimated average yield is 0.94 ton per acre. About 92 per cent of all hay is fed on the farms where produced.

The orchard fruit consists largely of plums and compass cherries. These are especially adapted to the climate of South Dakota and are very satisfactory fruits. There were 2,854 apple trees in the county in 1919. Strawberries and raspberries are grown and the plantings should be increased.

Common garden vegetables are grown with success, and an adequate supply for home use could be produced on all farms. The distance from large consuming centers precludes the development of market gardening as an important industry.

There was a substantial increase in the number of cattle other than dairy cows between 1910 and 1920. Cattle are not fed on all farms, but many farmers have a few head and others have larger herds. The increase in the corn acreage and tame forage has been an important factor in cattle feeding.

Dairy cows have decreased in number from 10,013 in 1900, to 6,114 in 1920. Dairying can be carried on successfully in Beadle County, but the extensive system of farming which has been practiced is not favorable to the industry.

Hogs are produced on most farms and pork production is increasing. Alfalfa, sweet clover, and corn are very favorable to the industry.

There were 10,620 sheep on the farms in 1920. The organization of a successful wool-marketing association among farmers has favored the development of this important business.

Farmers are beginning to appreciate the desirability of maintaining the fertility of the soil. Farm manures which formerly went to waste are now commonly applied to the soil preceding the corn crop. The value of legumes in soil conservation is being recognized and the most progressive farmers are increasing the acreage of these crops. The burning of straw was once nearly universal and is yet a practice too commonly followed, although in some localities straw is no longer burned. The increase in the corn acreage and the production of livestock have reduced the tonnage of straw wasted by burning.

The farm buildings vary from poor to excellent. Some of the farm houses have modern equipment including running water and electric light. The latter is not common, but where artesian wells have been sunk, house plumbing is or can be readily installed. The increase in the value of farm buildings during the last 20 years is indicative of the improvement in farm houses and other farm buildings. According to the census of 1900, the value of such buildings was $591,920; in 1910, the value was $2,678,615; and in 1920 it was $7,031,555. The increase in the value of farm implements and machinery during the same period indicates not only more adequate equipment, but an increase in the cost of equipment. In 1900 the investment in machinery was $217,470; in 1910, $897,103; and in 1920, $3,448,341. The value of all farm property was in 1900, $5,241,964; in 1910, $35,569, 871; in 1920, $82,277,250.

The number of farms increased for the same period from 1,094 in 1900 to 1,716 in 1920. The average size of farms in 1920 was 410.9 acres. In 1900 the average farm included 590.2 acres and in 1910 421.2 acres. Implements of large size are usually used on the farms, from four to six horses being used in a team. A team of five horses is most commonly used in plowing. A 2-bottom plow is generally used and the plowing averages from 3 to 6 inches in depth. Trac-

tors are common, but about four-fifths of the farmers reporting to the South Dakota Agricultural Station thought they were not a profitable investment. About one-seventh of the farmers reported that tractors are profitable, while some were in doubt.

Owners operate 57.6 per cent of the farms, while tenants operate 42.4 per cent. Tenants usually give a share of the crop, the amount varying from one-third to two-fifths and in a few cases to one-half of the crop produced. Pasture and hay lands are usually rented for cash.

SOILS.

The soils of Beadle County show by their most important characteristics the predominating influence of climate. Climatic conditions, uniform for the entire area, have acted upon materials assumed to have been variable in character and produced soils that are remarkably uniform in appearance and composition. Minor variations have resulted from differences in the texture of the original material or from restricted drainage, both of which have retarded or modified the action of the soil-forming processes.

The rainfall of the region is comparatively low and has not been sufficient to support a forest vegetation, but it has been quite favorable to the growth of a covering of short grasses. These grasses have been the source of the humus which imparts the black color to all the soils of the county. While the supply of moisture is sufficient to allow the accumulation of large quantities of organic matter from a vegetation of grasses, it is not sufficient to leach the soil to any great depth. On well-drained areas the carbonates, mainly lime carbonate, occur only in small quantities in the surface soil, the low content being due to a partial leaching, but they are in such abundance below the depths of 18 to 24 inches that an actual concentration is indicated.

The soil of the well-drained upland has reached a fairly uniform stage and one that may be regarded as mature for this climatic zone. The typical profile, covering a depth of 36 inches, is characterized by three distinct horizons; a very dark brown, almost black, loose, finely granular soil; a brown upper subsoil heavier in texture than the soil; and a light-colored friable, often floury, lower subsoil. The two upper horizons are not highly calcareous; they very rarely effervesce when tested with acid. The lower horizon contains a very large percentage of lime and other carbonates, including not only the amount in the parent material, but probably a concentration from above and below. Soils which have reached this stage of development on the upland appear on the accompanying map as types of the Barnes series. The Bearden series on the higher terraces has the profile just described and in a broad classification belongs to the same group. The Pierce soils on the upland and the Sioux soils on the terraces have loose porous subsoils and excessive drainage has prevented a large accumulation of lime, though it is present in quantities sufficient to make the material quite calcareous.

The soils of the Beadle series which occur on the nearly level areas of upland differ from the Barnes in having an extremely heavy and compact upper subsoil. This heavy claypan is no doubt due mainly to the influence of restricted drainage, but it is believed that the extreme thickness and compactness of the layer in certain local-

ities has been brought about in part by the impervious nature of the parent material.

Soils occurring on areas of still more restricted drainage, such as prevails in the upland depressions, flat terraces, and low flood plains, have developed a distinct profile. The surface soils are deep black and overlie gray or mottled highly calcareous heavy-textured subsoil. On the poorly drained uplands and terraces such soils have been classed with the Fargo series, on first bottoms along stream courses with the Lamoure series.

The soils of the groups described above have been differentiated into series on the basis of difference in structure, minor details of the soil profile, and the source, character, and processes of the accumulation of the parent material. A further subdivision of the series into types has been made. This rests entirely on the basis of the texture of the surface soil.

During the Pleistocene period the eastern half of South Dakota was overrun by successive ice sheets. The one furnishing the material for the soils of Beadle County was known as the Wisconsin sheet. This glacier brought from the regions farther north a heterogeneous mass of rock débris, picked up in its southward progress, and mixed it with material of local origin. The ice deposit—the parent material of the present soil—was laid down as a smooth plain, and this has been only slightly changed by erosion and weathering. The drift deposit varies in thickness from a few feet to over 100 feet. It is thinnest along Cain Creek south of Wolsey and on the east side of Sand Creek. Near the edges of the lobes of the ice sheet ridges of coarser morainic material were deposited. According to the United States Geological Survey,[2] there are two such moraines in Beadle County, namely, the Gary and Antelope moraines. Neither is continuous, but appears intermittently. The latter enters the county east of Turtle Creek and extends southeast, passing just west of Wolsey and Virgil and forming the isolated rolling areas in Altoona and Broadland Townships. In the eastern part of the county it extends through the eastern part of Belle Prairie and Logan Townships, passing out of the county just north of Iroquois. This part is not so well developed as that in the west. The Gary moraine lies in Kellogg, Burr Oak, Sand Creek, and Wessington Townships. The most marked areas are along the county line west of Sand Creek, and 3 miles south of Wessington.

The upland soils have been derived entirely from this glacial drift. A small area exists as reworked material and is mapped as old stream terrace. This material was laid down by glacial streams, but has almost the same level as the original drift. The original material in the eastern and northeastern parts of the county contained more shale and here the proportion of the finer soil particles is larger than in the remainder of the county, where more crystalline material was present in the original drift.

The Barnes series includes those types having a dark-brown or black surface soil passing into a friable brown subsoil, and this in turn into a yellow friable substratum of till, containing finely divided lime and lime concretions. The greater part of the area of Beadle County is composed of types of this series. Four types and two phases are mapped. The lighter types are found on the more undulating areas.

[2] Folio No. 113, United States Geological Survey.

The types of the Beadle series have surface soils ranging in color from dark brown to almost black and in depth to about 10 inches. The subsurface layer, which is 6 to 12 inches thick, is a compact clay loam or silty clay which has the nature of a hardpan. When dry it is hard and brittle and has a columnar structure. The color of this layer ranges from brown to almost black. The lower subsoil is a friable, highly calcareous material of light olive brown or grayish-yellow color. The areas of these soils have been subjected to little erosion, but are generally well drained. This series, which is derived from glacial till, has been developed in regions of low to moderate rainfall. The soils and subsoils of the series are similar to those of the Barnes series, and the series differs from the Barnes only in the presence of the compact subsurface layer. One type, with a phase, is mapped.

The Pierce series includes all upland types from stratified deposits and having a dark-brown or black surface soil and a brown, gray, or yellowish open and porous subsoil.

The higher, well-drained terrace soils are divided into two series, namely, Bearden and Sioux. Both have dark-brown to black surface soils. The Bearden subsoil is a grayish-yellow to yellow, smooth, friable very fine sand or silt containing lime accumulations. The subsoil of the Sioux series is open and made up of alternate layers of sand, gravel, and silt. Three types are mapped in each of these series.

The Fargo series includes types that are covered with water for sufficient periods to cause development under poor surface and soil drainage, resulting in the formation of deep black soils over fairly heavy, stiff, calcareous subsoils. Three types are mapped.

The alluvial soils fall into two classes—old and recent deposits. The old deposits give a poorly drained phase of the Lamoure silty clay loam. The surface soil is grayish drab to black and the subsoil consists of heavy, sticky, plastic material varying in color from gray to brown or black. Gravel and sand are often encountered at depths of 30 to 36 inches.

The recent alluvium gives rise to typical Lamoure soils. These have dark-brown to black surface layers and a heavier black to dark-drab subsoil. Lime is found in the lower part of the 3-foot section.

In the following pages of this report the soils of Beadle County are described in detail and their relation to agriculture discussed. The table below gives the name and actual and relative extent of the several soils mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Barnes loam	318,976	40.8	Barnes fine sandy loam	15,616	1.9
Rough phase	7,104		Fargo fine sandy loam	11,200	1.4
Barnes silt loam	109,248	14.1	Bearden silt loam	7,680	1.0
Rough phase	2,880		Bearden loamy fine sand	6,208	.8
Beadle silt loam	65,664	8.5	Lamoure loams (undifferentiated)	5,184	.6
Shallow phase	2,752		Swamp	4,800	.6
Barnes very fine sandy loam	61,760	7.7	Fargo silty clay loam	3,968	.5
Fargo silt loam	59,264	7.4	Sioux sandy loam	2,432	.3
Sioux loam	34,112	4.3	Sioux very fine sandy loam	1,856	.2
Lamoure silt loam	32,640	4.1	Pierce loam	1,344	.2
Lamoure silty clay loam	9,536	3.4			
Poorly drained phase	17,920		Total	800,000	.....
Bearden fine sandy loam	17,856	2.2			

BARNES FINE SANDY LOAM.

The Barnes fine sandy loam has a surface soil of black or dark-brown fine sandy loam, 4 to 10 inches deep, resting on a brown fine sandy loam, underlain at 18 to 30 inches by a grayish-yellow silt or silty clay loam. The grayish-yellow material occurs at greatest depth in the flats between the ridges.

Areas of Barnes fine sandy loam are mapped north of Wolsey in Allen Township and in Clifton and Custer Townships. The last two areas are uniformly flatter and have a deeper surface soil than the area first mentioned. Small gravelly knolls occur in the area north of Wolsey. Owing to the open, porous structure of the type it readily absorbs moisture. It warms up early in the spring, allowing early planting, and for this reason it is considered a good corn soil. It is not so fertile as the very fine sandy loam and not so productive. The largest yields are produced in the wetter seasons. Care should be taken in cultivating this soil, as it drifts if left exposed when plowed dry. The topography is level to undulating.

BARNES VERY FINE SANDY LOAM.

The Barnes very fine sandy loam consists of dark-brown or black very fine sandy loam, 6 to 8 inches deep, underlain by a brown, friable, very fine sandy loam to a depth of 18 to 24 inches, where the characteristic grayish-yellow lower subsoil is encountered. Variations from the typical are found north of Cavour, in the vicinity of Cavour Lake, and south of Hitchcock, where the grayish-yellow subsoil does not appear until the lower part of the 36-inch section is reached. The soil is usually deeper in the flats occurring between the knolls, owing to the drifting of sand into these lower areas. In general, the surface is flat to strongly undulating.

This type is highly valued, having good surface and internal drainage and also the structure to withstand drought. The type is especially adapted to corn and legumes. Small grains do well in favorable seasons, though not so well as on the heavier soils. As a whole the type ranks about equal to the Barnes loam.

BARNES LOAM.

The soil of the Barnes loam consists of 6 to 10 inches of dark-brown to black silt loam containing about 35 per cent of fine and very fine sand. Below this occurs a friable brown silt loam extending to a depth of 18 to 24 inches, at which depth a grayish-yellow or yellow friable silty clay loam appears. The material, especially in the lower part of the 3-foot section, contains large quantities of lime. The lower subsoil in the western third of the county has a grayish color.

A number of variations occur. In Sand Creek and Burr Oak Townships the soil and subsoil are heavier and the latter has a tendency toward compaction. In the western part of Wolsey Township the soil is slightly sandier than typical. The area mapped north of Lake Byron includes numerous small poorly drained areas whose subsoils indicate them to be of lacustrine origin, but because of their small size these areas could not be separated. Gravelly knolls occur

throughout this type, the larger ones being shown by gravel symbols. The subsoil of such knolls has a distinct yellowish-gray color. Small knolls having a shallow surface soil occur throughout this type. Other small areas having a very fine sandy subsoil of loose friable structure and brown to yellowish-brown color are encountered throughout the type. The largest of these is developed along the road south of Yale, and other areas are scattered throughout the county, but chiefly south of the Chicago & North Western Railroad and east of James River.

That portion mapped east of Hitchcock is a transitional type between the Barnes very fine sandy loam and the Barnes silt loam, consequently it approaches in texture a very fine sandy loam on the west and a silt loam on the east, the boundaries being indistinct. Small areas in this locality have a smooth, yellow silt subsoil, showing lacustrine origin. The small areas mapped in the northeastern part of the county have heavier subsoils with a tendency to compaction. It is doubtful if these areas are equal in production to the remainder of the type. Areas having a gravelly layer 3 to 8 inches in thickness in the subsoil are found near the large sloughs bordering the Bearden fine sandy loam north of Cain Creek in Clyde Township, and in Dearborn, Carlyle, and Grant Townships, also surrounding the Sioux loam in the northwestern part of Custer Township. Other areas of like character are in sections 4 and 9 of Pleasant View Township. These areas are said to be droughty during the drier seasons.

The Barnes loam is the most extensive type in the county. It appears throughout the county, but occupies only small areas in the northeast corner. The topography is undulating to gently rolling. The more undulating areas are confined to the two western tiers of townships and Hartland and Broadland Townships.

The Barnes loam is considered one of the best soils in the county. Its open structure and lime content make it favorable for bacterial action, and the legumes do well upon it. It is probably the best corn soil in the county, and good yields of the small grains are obtained.

The value of land of this type ranges from $75 to $150 an acre. Most of the farms on the Barnes loam are well improved.

Barnes loam, rough phase.—The rough phase of the Barnes loam has a soil section similar to the typical soil. It is separated solely on its topographic difference and consequent lower agricultural value. It includes the rougher parts of the morainic ridges and is marked by small gravel knolls that show as grayish areas in cultivated fields. Some of these knolls consist of stratified material, approaching in character that giving the Pierce soils.

As mapped east of Lake Byron, the type has a heavier and more compact subsoil. The topography is rolling. Most of the phase is used as pasture land, only small areas being cultivated. It is inclined to be droughty and gives about the same yields as the typical Barnes loam.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Barnes loam.

Mechanical analyses of Barnes loam.

Number.	Description.	Fine gravel.	Coarse. sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
360407	Soil	1.7	4.4	3.6	23.1	12.1	36.9	18.2
360408	Subsurface	1.0	4.5	4.1	25.2	12.8	35.9	16.4
360409	Subsoil	.7	3.6	3.1	21.9	13.9	37.1	19.8

BARNES SILT LOAM.

The soil of the Barnes silt loam, which ranges in depth from 8 to 20 inches, is a dark-brown to black friable silt loam. At this depth a layer of brown friable silt loam, 2 to 4 inches thick, is encountered, below which appears a grayish-yellow or yellow friable silt to silty clay loam. Lime is abundant in the lower subsoil. Sand and gravel occur through the soil section and larger glacial bowlders are scattered over the surface. The brown layer usually becomes slightly compact upon drying. In some of the lower situations where the black surface extends to 20 or 30 inches the brown layer does not appear, the black material resting directly upon the grayish-yellow or yellow till. Small fragments of shale and some limonite and hematite fragments are found in the lower part of the section, chiefly in the eastern third of the county.

The soil is the second in extent in the county. The largest and most typical area lies north of Huron, in Iowa, Fairfield, Lake Byron, and Pleasant View Townships. Another area is mapped at the junction of Logan, Richland, Pearl Creek, and Belle Prairie Townships, and still another in Burr Oak and Sand Creek Townships in the southwest. A small area occurs 6 miles north of Wessington. Besides these areas other small areas are scattered throughout the county. Those in the northeastern part of the county and the large area in Burr Oak and Sand Creek Townships have a more compact subsoil than typical, which resembles in places the heavy compact layer found in the types of the Beadle series. A small area in the northwestern corner of Sand Creek Township has a reddish-brown plastic silty clay below 26 inches and seems to be of lacustrine origin.

In sections 7, 8, 15, 17, 18, 23, 24, 25, and 26 of Fairfield Township the soil surrounding the marshes is much blacker and deeper than typical and the subsoil is slightly heavier. The black surface soil here contains a large percentage of organic matter and, gradually becoming heavier, extends to depths of 24 to 28 inches before the yellow layer is encountered. The brown layer here is in many places indistinct or absent. The difference in color and structure is due to the wet condition of the area. A similar condition is found in sections 8, 17, 20, 28, 29, 30, and 33 of Iowa Township and in the many small areas in Wessington and Wolsey Townships.

These areas were not considered of sufficient difference agriculturally to warrant separation from the Barnes silt loam. Eventually, if left in their natural condition, they would develop into Fargo, but the drainage that is taking place will eliminate this possibility.

The topography of the Barnes silt loam is flat, with scarcely any well-defined drainage channels.

This type is well adapted to alfalfa, sweet clover, and corn, but at the same time it is sufficiently compact to produce good yields of the small grains. Large areas are uncultivated and used as pasture or hay land. It is a very fertile soil and care should be taken to keep it in a high state of production by using crop rotations and other approved methods of soil management. The South Dakota Agricultural Experiment Station has worked out satisfactory rotations for this type. The value of land of this type of soil varies from $50 to $125 an acre, depending upon location and improvements.

Barnes silt loam, rough phase.—The Barnes silt loam, rough phase, is confined to the southwest corner of the county in Burr Oak Township. The surface soil, 6 to 10 inches deep, is dark brown to black and underlain by a thin layer of brown silty clay loam, which at 12 to 18 inches passes into the yellow silty clay loam lower subsoil typical of the types in the Barnes series. Numerous glacial bowlders and gravel appear on the surface. The phase occupies the rougher parts of the Wessington Hills and the greater part of it is unfit for cultivation. Practically all of it is used for pasture.

BEADLE SILT LOAM.

The surface soil of the Beadle silt loam consists of a dark-brown to almost black silt loam, 6 to 10 inches deep. This is underlain by a dark-brown clay loam, slightly lighter in color than the surface soil. At a depth varying from 16 to 24 inches a characteristic dark-brown or dark grayish brown very compact clay loam is encountered. When dry this layer is hard and almost impenetrable with the ordinary soil auger. It varies from 4 to 10 inches in thickness, the average being about 6 inches, and changes rather abruptly to a grayish-yellow or light olive gray clay loam streaked with white lime accumulations. This material, which extends below 3 feet, is similar to the subsoil of the Barnes types. In places the lower subsoil is discolored by iron stains and concretions, and in others small fragments of shale are abundant. Gypsum crystals appear in places in the lower part of the soil section.

The compact intermediate layer, which distinguishes this type from the Barnes silt loam, varies greatly in its position in the profile; road cuts showing that it may occur at any depth between 10 and 30 inches and may range from one extreme to the other within a very short distance. Its compactness is believed to be due to some kind of cementation rather than to the texture of the material. It is interesting to note that the average textural composition of this hardpan does not differ materially from that of the underlying soft friable material, the average percentage of sands, silt, and clay being almost the same.

The lower subsoil when moist is soft, smooth, and rather plastic; when dry it is usually friable and powders easily. Even when it dries as hard clods they break up much more readily than clods of the compact layer formed under similar conditions. In composition, however, there is a wide difference between the two; the compact layer, where well developed, is so leached of its carbonates that it will not effervesce with acid. This condition would indicate that the Beadle silt loam has reached a more advanced stage of weathering and leaching than the Barnes soils.

The Beadle silt loam is extensively developed in the northeastern part of the county. It extends from the northeastern corner southward along the eastern boundary about 23 miles and westward along the northern boundary about 12 miles, forming a triangular area containing about 270 square miles in which it is the prevailing soil type. There are also small, irregular, scattering areas lying south of these main bodies of the type.

The Beadle silt loam occupies flat to undulating divides in the upland. As a rule the surface of these areas is more nearly level than that of any of the Barnes types. Where a more rolling topography has given better drainage conditions, as near stream channels, the Barnes soils, mainly the Barnes silt loam, have developed. Numerous depressions too small to map, locally known as "burn outs," are scattered through the type. They vary from one to several square rods in area. The surface soils in such depressions are darker and slightly deeper than on the higher land.

In agricultural value this type ranks somewhat lower than the Barnes silt loam. Corn and the legumes do not produce as well, particularly where the subsoil is very thick and compact. Grasses and small grains, however, succeed as well as on any other soils of the county.

This land ranges in value from $60 to $100 an acre, but the average is lower than for the Barnes silt loam.

Beadle silt loam, shallow phase.—The shallow phase of the Beadle silt loam has the same succession of layers in the soil profile as the typical soil. The compact horizon or hardpan is, however, uniformly heavier and nearer the surface. It is often encountered within 4 inches. Gypsum crystals are very common in the lower subsoil. The small depressions, locally called "burn outs," are more pronounced, and there are other small depressions having a surface soil which is undoubtedly lacustrine. A study of the map will show that this soil occurs in flats at the heads of indistinct drainage ways, which in some cases have the appearance of being old shallow sloughs.

This phase is considered to be slightly inferior in crop adaptation and productiveness to the typical silt loam.

Below are given the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Beadle silt loam:

Mechanical analyses of Beadle silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
360437	Soil	1.1	2.6	2.0	9.6	17.0	49.8	18.0
360438	Subsurface	.5	14.2	6.4	18.0	3.8	31.2	26.0
360439	Subsoil	1.3	7.8	6.3	24.3	6.8	29.4	24.5

PIERCE LOAM.

The Pierce loam consists of a layer of brown to dark-brown or black friable loam, 6 to 9 inches thick, grading into a brown or yellow loam which continues to a depth of 24 to 28 inches, where brown sand and gravel are encountered. The large area in Burr Oak Township is lighter in texture in both soil and subsoil than typical.

This type exists as hills or low ridges having a substratum of stratified sand, gravel, and in places silt. The area in Burr Oak Township was probably formed as outwash from the Gary moraine. A large number of small areas could not be shown on the map and are included with other types, principally the Barnes loam. Most of these areas are cultivated; some of the sharper knolls exist as small grassy spots in cultivated fields. The type as a whole is droughty and gives the best yields in wet seasons. It produces excellent crops of corn and legumes when the rainfall is above the normal.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Pierce loam:

Mechanical analyses of Pierce loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
360440	Soil, 0 to 9 inches	2.0	5.8	8.2	29.6	10.0	34.7	9.6
360441	Subsurface, 9 to 26 inches	.7	5.2	9.2	52.4	9.2	16.0	7.2
360442	Subsoil, 26 to 40 inches	3.5	14.6	24.2	42.0	5.4	7.3	3.1

BEARDEN LOAMY FINE SAND.

The Bearden loamy fine sand is found associated with the Bearden fine sandy loam. The surface soil is a brown loamy fine sand. Below this, at 10 to 24 inches, there appears a yellow loamy fine sand, which extends to depths of 4 to 12 feet. The lower part of the profile has no organic matter and is very incoherent. A small area 2½ miles north of Huron on the Avenue Road has a gravelly layer at 4 feet. A sand pit located just south of this area shows no gravel at 12 feet, but the sand is coarser than at the surface.

The Bearden loamy fine sand exists as old stream deposits north of Huron, near Lake Byron, and along Cain Creek north of Wolsey. The topography of the type is flat to slightly undulating. The areas mapped within the Barnes fine sandy loam in Allen Township are not water laid, but simply low-lying areas which have been filled in with sand from the surrounding soils.

This soil drifts badly and care should be taken in cultivating it. It is considered good corn land, as it warms up early in the spring. Good yields are obtained in wet years, but the yield is affected by drought. Good yields of alfalfa and sweet clover are obtained. The Bearden loamy fine sand is valued at $100 or more an acre.

BEARDEN FINE SANDY LOAM.

The surface soil of the Bearden fine sandy loam is a dark-brown to almost black fine sandy loam, 8 to 14 inches deep. This surface layer grades into a brown fine sandy loam, which at 18 to 30 inches grades into a yellow or grayish-yellow smooth, friable silt, containing lime accumulations. Some borings in the more poorly drained areas show drab and brown mottling in the lower subsoil. Below the yellow layer at depths ranging from 4 to 10 feet gravel beds appear.

Along West Third Street in Huron gravel occurs within the 3-foot section, the yellow layer having its minimum thickness there. This

area extends west to the area mapped as Sioux loam. This part of the type is said to be droughty, but as a rule the type is quite resistant to drought. Other areas having gravel in the deeper subsoil lie along Cain Creek, south of Huron, but as the areas are small and of indefinite outline they are included with Bearden fine sandy loam. The gravelly layer here is normally overlain by a rather heavy, dark-colored silty clay layer, 3 to 6 inches thick.

The area west and southwest of Hitchcock has a blacker and deeper surface soil and a darker subsoil. That north of Lake Byron includes many small, poorly drained spots. In these low situations a black, drab, or grayish heavy silty clay, mottled with brown, is encountered at depths ranging from 12 to 30 inches. These areas were too small to map and were included with the fine sandy loam. In wet seasons, such as the spring and summer of 1920, crops on these low-lying areas are likely to drown out.

The largest area of the Bearden fine sandy loam lies in the vicinity of Huron. It was undoubtedly deposited as an outwash plain during the recession of the ice sheet. The same is true of the area along Cain Creek. The two plains originally joined, but parts have since been eroded away by the small stream 3 miles south of Huron, exposing the glacial till. Small knolls covered by Barnes soils are found scattered over these areas. The area west of Hitchcock lies at the confluence of two old stream courses. The area north of Lake Byron was probably laid down at the time ancient Lake Dakota was drained.

This is considered good corn land, as it warms up early in the spring, which allows early planting. It also gives good yields of the legumes. In favorable years small grains do well on the areas of heavier texture. This is a good truck soil. It is valued at $100 to $200 an acre.

BEARDEN SILT LOAM.

The surface soil of the Bearden silt loam is a dark-brown to black silt loam, 10 to 14 inches deep. At this depth the soil grades into a yellow or grayish-yellow, friable, smooth silty clay loam of uniform texture. The lower part of the subsoil is streaked with lime accumulations, like the subsoils of the upland types. Nearer the streams or outer edges the texture of both surface soil and subsoil are normally somewhat lighter than typical.

The largest and most typical areas of this type lie in the vicinity of Lake Byron and north of Foster Creek. A few small areas occur along the old stream course extending from Hitchcock to Huron. These are developed on old stream terraces. That around Lake Byron was probably formed at the time ancient Lake Dakota was drained. The yellow stratum in the area mapped in the northeast corner of Liberty Township is encountered some 30 inches below the surface and is slightly more compact than typical.

The Bearden silt loam has a flat topography, is easy to cultivate, and adapted to all crops grown in Beadle County. The areas in the old stream channels are likely to be wet in seasons of heavy rainfall. With care the productiveness of this soil can easily be maintained. The area in Valley Township has gravelly spots in the subsoil, which is slightly heavier, and the type here has a tendency to be droughty in years of subnormal rainfall.

SIOUX SANDY LOAM.

The surface soil of the Sioux sandy loam is a dark-brown medium sandy loam, 10 to 14 inches deep. Below this a lighter brown sandy loam appears and at 20 to 26 inches the material changes to a brown or reddish-brown coarse sand, gravel, or sand and gravel. The lower part of the profile is loose and incoherent. The type is derived from old sand-bar deposits that contain only small proportions of the finer soil particles. Most of it is mapped in the northeast corner of Whiteside Township. Some areas lie in Theresa Township. The topography is flat.

Good yields of corn are obtained during wet years, but crops are materially reduced in seasons of prolonged drought.

SIOUX VERY FINE SANDY LOAM.

The surface soil of the Sioux very fine sandy loam is a brown to dark-brown very fine sandy loam, 7 to 12 inches deep. The subsoil is a lighter brown very fine sandy loam to 16 or 20 inches, where it becomes a loose, open, porous coarse sand or gravel.

Areas of this soil are developed on old sand bars, and on areas lying at the junction of old stream courses. It is found chiefly north and west of Wolsey. The area 2 miles southwest of Wolsey has a heavier surface than typical and a compact silt layer above the gravel, as in the loam of the series.

The Sioux very fine sandy loam is adapted to the same crops as the loam, though the small grains do not yield as well as on the heavier type. The topography is flat to slightly undulating. Land is valued at $50 to $75 an acre.

SIOUX LOAM.

The surface soil of the Sioux loam consists of 8 to 15 inches of dark-brown to almost black loam. The subsoil is a loose, friable, brown loam extending to 24 to 30 inches, where a brown or gray gravel is encountered. As mapped in Beadle County, a 4 to 6 inch layer of silt or silty clay, ranging in color from gray to black, lies in most places just above the gravel.

In wet seasons this gravelly layer contains an abundance of water when the soil above is only moist, the layer just above the gravel preventing the water from coming to the surface. This silty layer prevails over the large area between Shue Creek and Lake Byron and in the area southeast of Broadland. In the areas lying along Pearl Creek in the southeastern part of the county the brown subsoil is rather compact. The area in the southwest corner of Wessington Township and those along the old stream courses in the western part of the county seldom have the silt layer. The change from the brown subsoil to the gravelly substratum is sharp and well defined in road cuts. These areas apparently are more droughty than those in which the silty stratum is well developed. The area southeast of Broadland has a lighter surface soil than the rest of the type.

This soil occurs typically as terrace and as outwash plains along old stream courses, where it was deposited in glacial times. The silty layer is believed to have resulted from the concentration of the

fine particles just above the gravel, the latter serving as a filter for the percolating waters.

Areas of Sioux loam are practically always developed at the junction of old stream channels. The long areas mapped in Nance Township are old sand bars with an accumulation of finer soil particles on the surface. Some of the areas along Pearl Creek, the area north of Virgil, and the large area in section 23 of Sand Creek Township have silt surfaces. In the latter the black soil extends to a depth of 24 inches. The topography is flat to slightly undulating. Small knolls of Barnes soils are found associated with the larger areas in Custer, Iowa, and Liberty Townships. The gravel substratum is used for road and building material when found in sufficient quantities. The most important sand and gravel pits on this type are just west of Huron.

The greater part of this type is fairly retentive of moisture and produces good yields. Some of the best corn in the county was seen on this type during the progress of the survey, which was made in 1920, an exceptionally wet year, the open structure of the soil enabling it readily to dispose of the excess moisture. Corn averages 25 bushels and yields of 50 bushels are sometimes obtained. This also is a good legume and small-grain soil. The Sioux loam is valued at $75 to $100 an acre.

FARGO FINE SANDY LOAM.

The Fargo fine sandy loam is a black or dark grayish brown fine sandy loam, 6 to 12 inches deep, grading into a light-yellow or gray fine sandy loam extending to 20 or 30 inches, where a compact, drab or black silty clay layer mottled with gray or brown is encountered.

The type as mapped in Theresa Township, excepting the areas in the northern part, normally has a gray substratum mottled with yellow and brown. That in the northern part of the township is uniformly a yellow silt mottled with gray in the subsoil. In section 1 of this township dark-gray clay was encountered within 8 or 10 inches of the surface.

The gray color of the substratum in Theresa and Grant Townships is due to a wetter condition which prevents oxidation. In Clifton Township the substratum has a darker color, being black to drab. The areas mapped north of Wolsey, within the large areas of Barnes fine sandy loam, are Fargo silt loam areas which have been covered with 12 to 30 inches of sand material. Those found within the Bearden soils are poorly drained areas of Bearden. During wet springs this type is covered with 6 to 24 inches of water. This usually drains off during the summer. In average seasons the water disappears rather rapidly, allowing cultivation, although there are many small included areas that remain in a wet condition throughout the summer.

When sufficiently drained this is considered a good corn and truck-crop soil. At present a drainage project is under consideration which will eventually drain most of this type in the vicinity of Huron.

Alkali spots are found throughout the type. Draining the land should remove this alkali. The drainage waters from a farm which was tiled in 1919 showed the presence of alkali.

FARGO SILT LOAM.

The surface soil of the Fargo silt loam is a dark-brown to black silt loam with a depth of 8 to 20 inches, the thickness of this layer being deeper in the better drained areas. The soil grades downward into a drab or gray silty clay which extends to 36 inches. Mottlings of brown, yellow, or gray appear in many places in the lower part of the 3-foot section. The subsoil is calcareous.

In the areas in the two southern tiers of townships the yellow subsoil material typical of the Barnes series is reached at 30 inches, but these areas are included with the Fargo because they are poorly drained and often under 2 feet or more of water in wet seasons. In the areas lying along Lake Byron the material throughout the 3-foot section is black. Many spots of this soil too small to map occur in areas of the Barnes loam and Barnes fine sandy loam and to some extent in other soils.

The Fargo silt loam is poorly drained. It occupies depressions or old shallow drainage ways, the latter position being common in Valley, Hartland, Wolsey, and Wessington Townships. Some areas form marshes which are wet throughout the year. These are shown on the map with the marsh symbol. Others dry before fall, allowing the cutting of hay.

The soil is fertile and easy to handle when dry. The greater part of the type at present is used as hay land. The yield of hay ranges from 1½ to 2 tons per acre. In average years many areas of the type are not covered with water and can be used for crops. Small grains and corn give good yields. Alfalfa and sweet clover scald and freeze out in the wetter years, but produce large yields on the better drained areas in favorable years. Drainage will allow the cultivation of a large percentage of this type that now can be used only as pasture and hay land. Several drainage projects were under way during the survey.

The presence of this type in a farm does not affect land values, except when it forms a large proportion of the farm and is exceedingly wet.

FARGO SILTY CLAY LOAM.

The Fargo silty clay loam consists of brown to black silty clay loam 7 to 24 inches deep, grading into a heavier and lighter colored brown or drab clay, which in the lower part of a 3-foot section changes to a gray clay, mottled with yellow and brown.

The Fargo silty clay loam is not developed very extensively in Beadle County. It occupies the larger depressions, such as that in the northwest corner of Valley Township. Here small, slightly elevated areas having a typical Barnes subsoil are included. The type is usually flat and under water during the spring, but dries off during the summer and produces a luxuriant growth of coarse grass, used as forage. If drained and tiled this type would be very productive and well adapted to timothy and small grains. This soil is hard to handle. Only the better drained areas are cultivated. Here good yields are obtained. Land of this type sells for $90 to $100 an acre.

LAMOURE LOAMS (UNDIFFERENTIATED).

The surface soil of the Lamoure loams (undifferentiated) varies from a fine sandy loam to loam, and as mapped includes small areas

of Lamoure silt loam and Sioux loam. The surface soil grades at 8 to 12 inches into a subsoil of dark-drab or gray clay, mottled with brown. The dark color of the subsoil persists to 3 feet or more.

The small area found in Custer Township is the most uniform. The areas along James River are narrow strips of sandy soil washed down from the surrounding upland. That along Sand Creek and the lower part of Shue and Pearl Creeks is almost uniformly sandy, with small included areas of silt. Along Pearl Creek in Richland Township the soil has the position of a terrace and lies above overflow. The part of the type subject to overflow is developed in strips too narrow to map. The surface in these is a loam with gravel in many places within the 3-foot section. Along Shue Creek old stream terraces are included, as they could not be shown separately. These occur within the bends as points or slopes from the upland to the stream. At their outer edge they are with difficulty distinguished from the upland. The surface soil of these terraces ranges in texture from fine sandy loam to heavy loam and the profile from Sioux to Lamoure. Practically all of this type is in pasture except that in Richland Township and that at the mouths of Pearl and Shue Creeks. Where cultivated it produces good crops.

LAMOURE SILT LOAM.

The Lamore silt loam is typically a dark grayish brown to black friable silt loam, 8 to 16 inches deep, passing into a dark-drab or black silty clay loam, which grades at about 24 to 30 inches into a drab sticky clay. Brown mottlings appear in many places in the material of the lower part of the 3-foot section. The subsoil is highly calcareous.

The most typical and extensive areas lie in the flood plains of James River and Turtle Creek. Near the stream a narrow strip of lighter soil is found. It gradually becomes heavier away from the streams, and is heaviest near the upland. Near the upland the stream current is slowest, allowing the finer soil particles to settle out, and giving rise to deposits of heavier texture. In the area of the old stream course mapped in the northern part of Nance and Bonilla Townships a heavy, black, compact clay subsoil is encountered within 8 to 16 inches of the surface, causing droughtiness. The areas in the old stream course extending from Hitchcock to Huron are yellow in the lower part of the 3-foot section. They are slightly elevated but not sufficiently well drained to be classed as Bearden.

Small areas of lighter textured surface are included with this type along Sand and Cain Creeks. That mapped along Little Pearl Creek in Logan and Belle Prairie Townships and along Pearl Creek in Banner Township occasionally shows a gravelly layer in the lower part of the 3-foot section.

This type is frequently overflowed, except where it occupies a position on a terrace, in which case only a very narrow strip along the streams may be flooded.

This soil is highly prized, being very fertile and productive. It gives excellent yields of small grain, and its open structure, favoring drainage and warmth, makes it a good soil for growing corn, alfalfa, and sweet clover. Excellent fields of all these crops were seen on

this soil during the survey. The native grasses grow luxuriantly upon this Lamoure soil and supply hay of fairly good quality. The greater part of the type is in cultivation. It sells from $75 to $125 an acre.

LAMOURE SILTY CLAY LOAM.

The Lamoure silty clay loam differs from the silt loam in that the surface soil is shallower and heavier and the subsoil and substratum are grayer. Material of drab and gray color appears at depths ranging from 6 to 10 inches.

This type is confined to the sluggish courses of the James River where the current is sufficiently retarded to allow the deposition of the finer soil particles. The large area mapped in Burr Oak Township differs from the typical in that the surface is darker and deeper. At 16 to 20 inches it grades into a black silty clay containing lime stains and at about 28 inches into a compact, brittle, brown to olive-brown clay containing lime stains. Cuts along the road show this to rest on material resembling the Barnes subsoil at depths ranging below 30 inches. The compact layer resembles that found in the Beadle soils, but is uniformly darker in color, in many places appearing black. In Jerauld County this compact layer is much better developed. The black soil is probably a colluvial deposit that has accumulated upon a substratum of the till. Most of the small areas are in grass. The large area in Burr Oak Township is practically all under cultivation. The type, as a whole, is a little later to warm in the spring than the silt loam. During extremely wet seasons the Burr Oak area is completely under water for short periods. Small areas of clay in Burr Oak Township were included with this type, on account of their small extent. They differ from the clay loam only in the heavier texture of the surface soil.

Lamoure silty clay loam, poorly drained phase.—The surface soil of the Lamoure silty clay loam, poorly drained phase, consists of a dark-gray or black silty clay to clay, 4 to 8 inches deep, the layer being thickest in the better drained areas, such as those mapped along the county line west of the Chicago, Milwaukee & St. Paul Railway in section 34 of Carlyle Township, and southwest of Broadland and north of Wolsey. The soil is underlain by a sticky, plastic, drab or gray clay, grading at 26 to 30 inches into a yellowish-gray or yellow clay, mottled with brown and gray, and containing in many places pockets of sand or gravel. Gypsum crystals are frequently found in the lower part of the soil section.

This phase occurs in old, poorly drained valleys, like those occupied by Cain and Silver Creeks, and the old channel between Hitchcock and Huron. There are two small areas in Belle Prairie and Custer Townships. An area in Custer Township appears to be an old obstructed stream channel. The areas of shallower surface soil lie in the northern extremities of Silver and Cain Creek channels. Here the surface material is heavier and only about 4 inches deep, and the subsoil is much grayer and more water-logged. The streams flow in shallow channels and the water spreads out over the entire area to a depth of 6 to 30 inches in the spring and wetter seasons. As the streams flow toward the south, the channels become better defined and carry off the water more rapidly. This allows the soil

to become better oxidized and also favors a greater accumulation of organic matter. It is here one finds the darker and better surface soils and the gradual change into the typical Lamoure. There are several knolls having a section very similar to the Lamoure silty clay loam in the Hitchcock-Huron channel, but these are included with the poorly drained phase.

In the large area situated in Nance, Whiteside, and Allen Townships many small knolls having a very fine sandy surface are found. These are a few inches above the general level of the type and very noticeable when the water recedes. These sandy knolls seldom have an area of more than 10 square rods and diminish in number to the south.

The poorly drained phase is water-logged and large areas are incrusted with alkali. It is used exclusively for pasture and hay land. Yields of 1½ to 2 tons of hay are obtained. One field of corn was seen on one of the better drained areas already mentioned. It was in very poor condition. During the late summer months the soil becomes hard and compact.

Drainage systems will have to be established on this soil to remove the alkali and excess moisture and give aeration before it can be successfully cultivated.

SWAMP.

A comparatively small total area, between 7 and 8 square miles, is classed as Swamp. This occupies permanently wet depressions, in which the soil varies with the surrounding types.

The individual areas of Swamp are small. They occur in nearly all sections of the county, but are most numerous in the northern half. Swamp has no agricultural value in its present state.

SUMMARY.

Beadle County lies in the James River Valley, in east-central South Dakota. It has an area of 1,250 square miles or 800,000 acres. The elevation ranges from 1,200 feet to slightly over 1,400 feet. Drainage is poorly established.

The population of the county in 1920 was 19,201, of which 11,899 is rural. The county seat and principal town is Huron.

The winters are long and cold, and the summers short and cool. The mean annual temperature is 42.1°F., and the mean annual precipitation 21.10 inches. The average growing season is 134 days.

The county was first settled in 1880. Cattle raising, the first industry, gradually gave way to wheat growing, which is now being followed by corn as the principal crop with definite and well-planned farm management. Grain farming is now the predominating type of agriculture, and the value of the grain crops is two-thirds of the value of all farm products. Livestock ranks second in importance. Poultry, dairy, and vegetable products are of minor importance, but the first two are becoming more and more important.

The soils of the county are derived from glacial drift, either weathered in place or transported and redeposited as glacial terraces or as recent alluvium. The drift is derived from granite, limestone, sandstone, and shale rocks, fragments of the last named being more numer-

ous in the drift covering the northeastern part of the county. The drift varies in thickness from a few feet to over 100 feet. The soils are classed in 7 series and 18 types, four of which have phase separations, and Swamp.

The soils derived from glacial drift are classed with the Barnes, Beadle, and Pierce series; those from reworked drift, i. e., the glacial lake and river terrace soils, with the Bearden, Sioux, and Fargo series; and the recent alluvial soils with the Lamoure series. The Barnes soils are the most extensive, forming about 65 per cent of the area of the county. The soils of the Beadle series are the next in importance. Large numbers of old stream courses exist throughout the county, particularly in the western portion. The soil found developed in these is very poorly drained and is valued only as pasture and hay land. The Fargo soil is mapped in poorly drained depressions and lake beds, the Lamoure along the streams.

Lime occurs abundantly in the subsoil throughout the county.

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE
SOUTH DAKOTA COLLEGE OF AGRICULTURE

SOIL MAP

SOUTH DAKOTA
BEADLE COUNTY SHEET

Soils surveyed by W. I. Watkins, in charge, and C. E. Deardorff of the U. S. Department of Agriculture and J. G. Hutton and J. A. Machlis of the South Dakota College of Agriculture.

Scale 1 inch = 1 mile

Field Operations
Bureau of Soils
1920